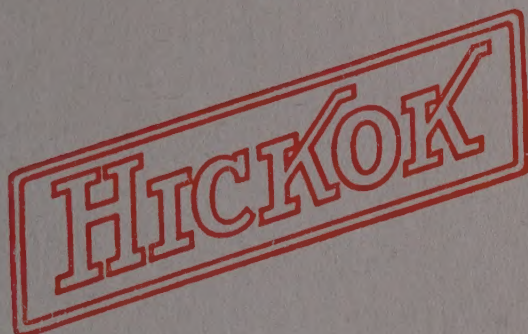


1282

OPERATING INSTRUCTIONS

FOR

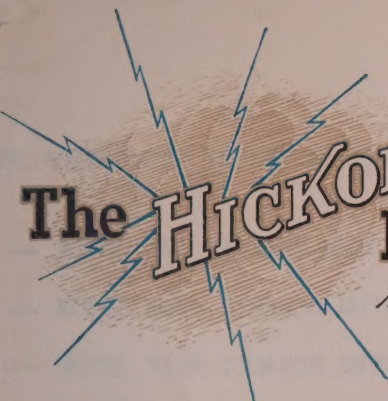


RADIO TEST EQUIPMENT

MODEL 530

MFG. BY

THE HICKOK ELECTRICAL INSTRUMENT COMPANY
CLEVELAND, 8. OHIO. U. S. A.



The HICKOK

Electrical Instrument Company

Manufacturers of a complete line of

**INDICATING INSTRUMENTS AND
RADIO SERVICE EQUIPMENT**

OFFICE AND FACTORY • 10514 DUPONT AVENUE • CLEVELAND 8, OHIO

Mr. K. Bush
Fransworth Television & Radio Corp.
Fort Wayne 1, Indiana

May 19, 1947

Dear Sir:

Replying to your letter of May 16th., requesting test data for the late type tubes, to be used with your model 530 tube tester.

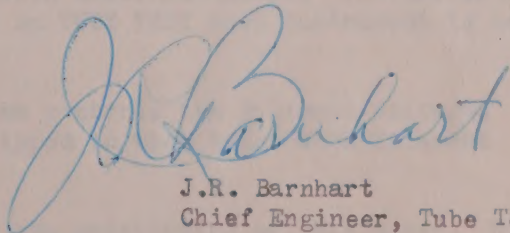
Your model 530 tester does not have the red and ivory miniature sockets that are required for testing the late type miniature tubes; therefore I am sending you a diagram showing how to wire these sockets into your tester.

Included is a supplement list of test data for the late type tubes.

Trusting that this will give you the desired information, I remain

Yours very truly,

THE HICKOK ELECTRICAL INSTRUMENT COMPANY



J.R. Barnhart
Chief Engineer, Tube Testing Division

JRB:gb
Attached

THE INSTRUMENT PACKED HERewith IS:

1 -- MODEL 530 DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER _____

1 -- MODEL 530B DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER _____

1 -- MODEL 510X DYNAMIC MUTUAL CONDUCTANCE COMBINATION TUBE TESTER AND
ANALYZER _____

ACCESSORIES INCLUDED WITH THE 530 TESTER ARE _____

1 -- INSTRUCTION BOOKLET FOR 530 _____

1 -- GRID CAP _____

SERIAL _____

SIGNED _____

ACCESSORIES INCLUDED WITH THE 510X TESTER ARE _____

1 -- INSTRUCTION BOOKLET FOR 510X _____

1 -- BOOK OF TUBE SETTINGS _____

1 -- PAIR FLEXIBLE LEADS WITH PINS AND PRODS _____

1 -- CONDENSER CABLE WITH PLUGS, PIN TIP AND ALLIGATOR CLIP _____

SERIAL _____

SIGNED _____

READ THESE INSTRUCTIONS THROUGH BEFORE ATTEMPTING TO OPERATE TESTER.

1. FUNCTIONS OF VARIOUS CONTROLS:

(a) The Selectors "A" and "B" control the socket contacts. Plate, Grid, Cathode, etc., are led to any combination of socket contacts as required. These switches are fully wired but only slightly more than one-third of the available combinations are used with tubes announced. The master switch (see page 11, on 510X only) must be set on TUBE TEST when instrument is used as a tube tester.

(b) The Center switch in the top row controls the filament voltage. The 530, 530B, and 510X testers are now equipped to test tubes with filament voltage to 117 volts.

(c) The Potentiometer "L" controls the sensitivity of this meter. When set at 60 (Gm) the scale is read in micromhos from 0-3000. When set at 7/ the micromho scale readings from 0-6000. When set at the micromho scale reads 0-15,000. The other settings for the left potentiometer as given in the chart after each type of tube are used when it is required that a good tube read in the green sector of the meter. This Red-Green scale is the so-called

English Reading Scale. This scale is used when testing tubes for customers who know nothing about micromhos. As an example, a No. 24 tube when the left potentiometer is set at 60, should read 1000 micromhos, but when the left potentiometer is moved to 42, as given in the chart under "L" settings, the meter should read in the green sector. In either case, the reading is dynamic mutual conductance. Those "L" settings for the various types of tubes are chosen so that a power tube will be rejected when it is down 25%, and an amplifier tube when it is down 20% below standard. (Manufacturer's Specifications.) This dual scale feature is found only in HICKOK instruments.

(d) The Potentiometer "R" controls the "C" bias on the tube. Different tubes are operated at different values of "C" bias. A change in "C" bias causes a change in mutual conductance. The "R" settings as given in the chart are correct for each type of tube and are the same whether using the micromho or English Reading scales.

(e) The Short Test-Tube Test Switch enables checks for shorts to be made before making the regular tube test. Turn the switch through the positions 1-2-3-4-5 while watching the neon short lamp. If the lamp burns continuously in any one of these positions, the tube contains a "SHORT." An instantaneous flash as the switch is moved from one position to another is to be disregarded. That is caused by the charging of a condenser in the circuit. Intermittent shorts can be detected by tapping the tube with the finger. If tube is found to be free from shorts, turn switch to Tube Test position for regular tube test. See "NOISE TEST."

(f) The Short Lamp is a 1/4 watt, 110 volt, candelabra base neon signal lamp made by The General Electric Company. This lamp will last indefinitely unless broken.

(g) The Fuse Lamp is a standard No. 81, single contact auto bulb. This can be procured from any auto dealer or gasoline station attendant. This fuse lamp is in the primary circuit of the transformer.

(h) Line Adjustment. This control is a rheostat in primary circuit of the transformer. Set Master Switch at bottom of panel on TUBE TEST. Press Line Test button and adjust knob until pointer of meter is exactly over the mark "LINE TEST" on the dial. Make this adjustment while the tube being tested is in the socket.

(i) The ON-OFF switch is for turning power on or off.

(j) There are two push buttons marked "Rectifier Test." The one marked "ST'D" (Standard) is for all standard filament or heater type rectifier tubes. The button marked OZ4 is used when testing the gaseous rectifiers OZ3 and OZ4 made by Raytheon. Rectifier tubes are made for each plate.

(k) In the center of the panel are two push button marked "GAS TEST" and "AMP. TEST." The button "AMP. TEST" is used when testing all tubes having mutual conductance, that is, all amplifier tubes. This includes all kinds of amplifier tubes and power tubes, but is not to be used when testing Rectifier or Diode tubes. On the chart under "Notation" will be noted the injunction "Press Rect. Button" or "Press Diode Button" after certain tubes. Where no specific instruction is given, the AMP. Button is to be used. Some tubes contain both an amplifying and a rectifying element or amplifying and diode elements. Those tubes, such as the 6B6 and 12A7 are listed for each element that is being tested.

(1) GAS TEST: A tube can be checked for gas content as follows:

1. Set the "L" Potentiometer on 60 (Gm) and hold down button marked "GAS NO. 1". Adjust "R" Potentiometer until meter reads 100 micromhos. Hold down "GAS NO. 1" and press "GAS NO. 2." If the meter hand moves more than ONE of the small divisions, the tube contains too much gas.

2. Some tubes develop gas after being heated for a period of time. If a tube is suspected, allow it to heat for a few minutes.

3. Some tubes such as the 45 and 71A cannot be brought down to 100 micromhos by turning the "R" knob. In that case, turn "R" to 82 and test for gas.

(m) The Line Test Button has been described under Par. (h).

(n) Diode Test. The Diode Test Button is to be pressed when testing a diode element of a tube. This places a low voltage on the element as recommended by tube manufacturers. DO NOT press AMP. or RECT. buttons when testing a diode element as the high voltage applied will paralyze the diode element.

2. As an example, suppose we are testing the 6B6 tube which contains an amplifying element and two diode elements.

(a) First, of course, we check for shorts.

(b) Assuming tube contains no shorts, we check next the amplifying element. Consulting the chart we find the following settings for the amplifying section: A, 7----B, 5----Fil., 6.3----L, 32----R, 10. As this is the sector, say slightly above the G in Good. We now wish to know the actual micromhos of this tube. We turn the "L" knob to 60 (Gm) and note that the meter reads 800 micromhos. As this agrees with the value given in the chart, we know that the tube is normal as to the amplifier section. We next check No. 1 diode; from the chart, we note that the settings are A, 10----B, 5----Fil., 6.3----L, 0----R, 0. We note that chart states Press Diode Button. If the pointer of the meter rises above the mark designated "Diodes OK," the No. 1 diode element is OK. No. 2 element is tested in the same manner; merely change "B" from 5 to 2.

DYNAMIC MUTUAL CONDUCTANCE -

- WHAT IT IS -

- WHY IT IS THE ONLY EXACT TEST,

3. Conductance is the opposite of resistance. The greater the conductance of a tube, the easier it is for electrons to flow through it. Mutual means "pertaining to both of two things." The two things considered when measuring "mutual conductance" are the grid and the plate of the tube. The plate will pass current but its value will depend upon the grid voltage as well as plate voltage. Therefore, the conductance of the tube depends on both the plate and the grid voltages. It is MUTUAL CONDUCTANCE. Dynamic pertains to motion. In measuring "Dynamic Mutual Conductance," the tube must be working. To simply take an emission reading is meaningless, because the tube is not working. Likewise, to take a reading, then shift the grid and take another reading is simply finding the difference between two static readings. That is not "Dynamic Mutual Conductance." In the 510X and 530 tube testers, there is applied signal voltage which modulates the plate current. The meter measures

the amount of modulation or dynamic mutual conductance.

Due to the success of the HICKOK line of Dynamic Mutual Conductance Tube Testers, some of our competitors are attempting to mislead the public by calling their product "Dynamic Mutual Conductance" testers. Do not be fooled -- unless the tester reads in actual micromhos, it is NOT dynamic mutual conductance tester.

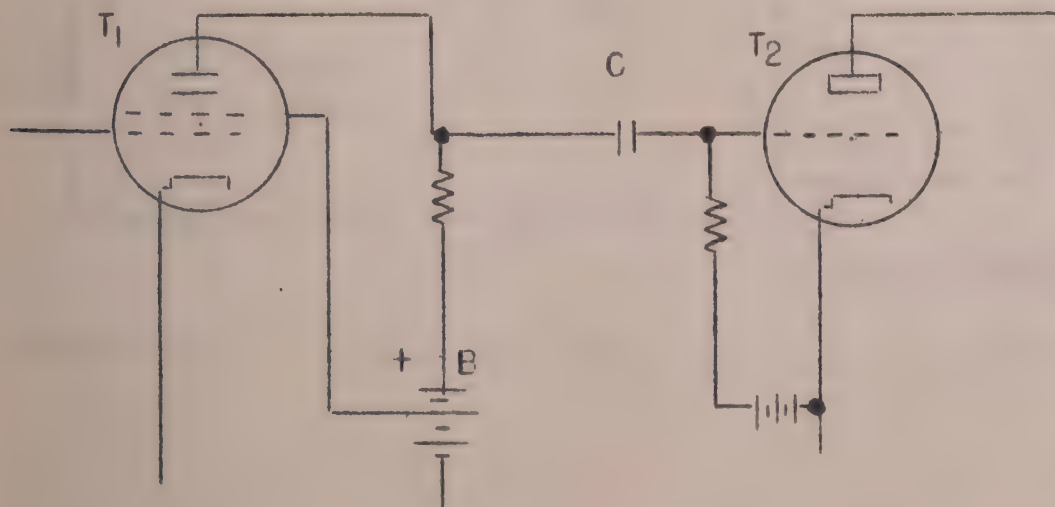
The three principle characteristics of a vacuum tube are amplification factor, plate resistance, and mutual conductance. To measure the amplification factor or plate resistance alone will not give a measure of the value of the tubes as an amplifier, but mutual conductance is tied in such a way with amplification factor and plate resistance that mutual conductance is the quotient of amplification factor divided by plate resistance. In the form of an equation, it will look like this:

$$G_m = \frac{\mu}{r_p}$$

WHERE: G_m is mutual conductance.
 μ is amplification factor.
 r_p is plate resistance.

It is thus seen that when we measure mutual conductance, we automatically measure both the other two characteristics. So mutual conductance is a 3 in 1 measurement. That is why it is considered first in importance by tube engineers and manufacturers.

The following simple illustration will make clear the value of the mutual conductance test, and the fallacy of the omission test.



The above figure represents a conventional stage of resistance coupling. The gain for this stage is the product of the resistance, R multiplied by the Mutual Conductance in Mhos of the tube T_1 . Suppose R is 100,000 ohms and the mutual conductance of T_1 is 750 micromhos; then:

$100,000 \times .00075 = 75$. which is the gain. If the mutual conductance were 700 micromhos, the gain would be 70, etc. There is no correlation between omission and gain.

Likewise, in an r-f transformer coupled stage, the voltage amplification or voltage gain is expressed:

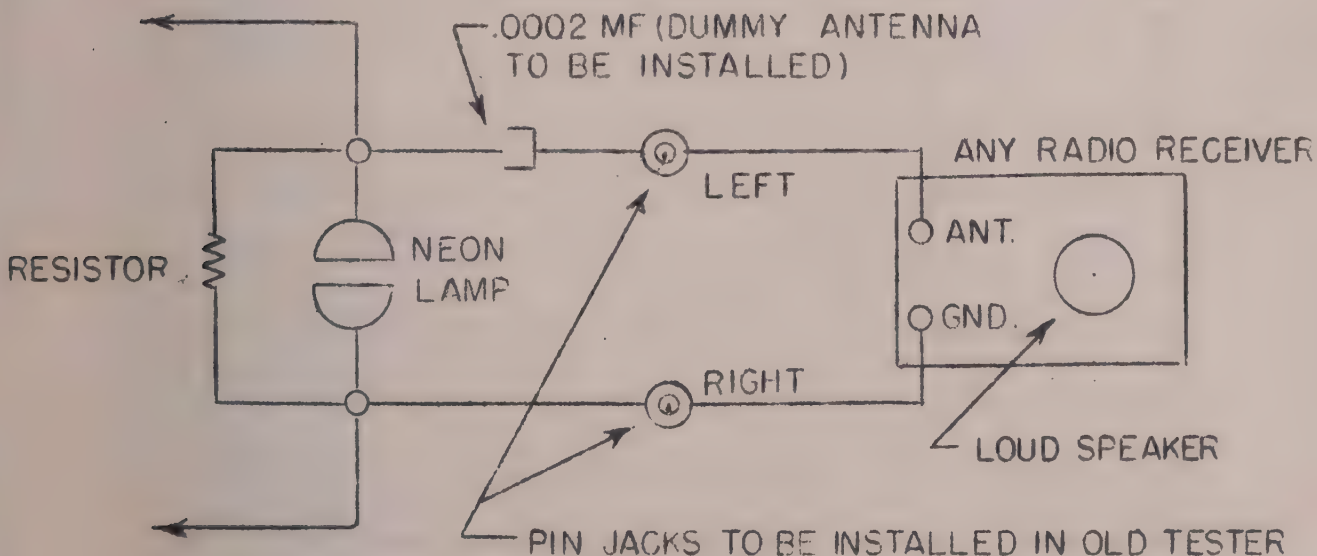
$$\text{Gain} = \frac{r_p \times R_P}{r_p - R_P} \quad \text{Multiplied by the mutual conductance of } T_1$$

WHERE: r_p is the plate resistance of T_1 and R_P is the load resistance.

That you may demonstrate in a very convincing way the effects of a noisy tube in a radio receiver, we have incorporated in the circuit of the 510X and 530, a simple but effective noise test.

The following diagram which explains its operation also shows you how this test may, in a few minutes time, be installed in any of our previous models of tube testers which have the noon short test.

In the 510X and 530 testers, the pin jack to the LEFT is to be connected to ANT. post of radio receivers.



HOW THE NOISE TEST OPERATES

As the Short Test switch on the tube tester is rotated through the points 1-2-3-4-5, tap the tube under test with the fingers. Any loose or jangling elements will cause loud crashes of static in the loud speaker. Sixty cycle hum cannot get through the R-F stages of the radio receiver.

LOCATING SHORTED ELEMENTS: In the following table, X under any selector switch position indicates that Neon Lamp burns in that position.

SELECTOR SWITCH POSITION

KIND OF SHORT	1	2	3	4	5
FIL. - CATHODE				X	X
FIL. - GRID			X	X	X
FIL. - PLATE	X	X	X		
FIL. - SCREEN		X	X	X	X
CATHODE - GRID			X		
GRID - PLATE	X	X		X	X
GRID - SCREEN		X			
PLATE - SCREEN	X			X	X
CAP. - FIL.	X	X	X	X	
CAP. - GRID	X	X			X
CAP. - CATHODE	X	X	X		X
CAP. - SCREEN	X				X
CAP. - PLATE				X	
SHELL - FIL.	X				
SHELL - PLATE		X	X		
SHELL - GRID	X		X	X	X
SHELL - SCREEN	X	X	X	X	X
SHELL - CATHODE	X			X	X
SHELL - CAP.		X	X	X	

BALLAST TUBES

INSTRUCTIONS FOR TESTING "BALLAST TUBES" ON THE 530 AND 510X TESTERS.

In the following chart of settings, an "X" under any "Short Switch" position indicates that neon lamp will light in that position with Selectors A and B set as shown following the tube type number.

Certain ballast tubes having complicated internal connections, such as the K36H, have three selector settings for complete test.

Noisy ballast tubes are detected by using the Noise Test, same as for other tubes. Tap tube with fingers while making test.

NOTE: ALWAYS SET FILAMENT SWITCH ON "BLST" POSITION. SHORT TEST SWITCH IS NOT TURNED TO TUBE TEST POSITION.

BALLAST TUBES

<u>TUBE TYPE</u>	<u>SELECTOR</u>		<u>SHORT SWITCH POSITION</u>				
	A	B	1	2	3	4	5
1A1-1B1-1C1-1E1-1F1-1G1-1J1- 1K1-1L1-1N1-1P1-1Q1-1R1G-1S1G- 1T1G-1U1G-1V1-1X1-1Z1-2	1	1	X	X	X	X	
2UR224- - - - -	3	1	X	X	X	X	X
2LR212 - - - - -	(2 (3	12 2	X X	X X	X X	X X	X X
3 - - - - -	1	1	X	X	X	X	
03G - - - - -	1	1				X	X
4-5 - - - - -	1	1	X	X	X	X	
6-133 - - - - -	1	1				X	X
7-8-9 - - - - -	1	1	X	X	X	X	
10A-10AG- - - - -	1	1				X	X
10AB - - - - -	1	1	X	X	X	X	
K17B-M17C-BM17C - - - - -	3	1	X	X	X	X	X
M17HG-M17H - - - - -	(4 (5 (7	4 1 12	X X X	X X X	X X X		X X X
K23B-K23C-KX23B-KX30C - - - - -	3	1	X	X	X	X	X
	(4	4	X	X	X		X
M30H - - - - -	(5 (7	1 12	X X	X X	X X		X X

BALLAST TUBES (Continued)

<u>TUBE TYPE</u>	<u>SELECTOR</u>		<u>SHORT SWITCH POSITION</u>				
	A	B	1	2	3	4	5
30A-K30A - - - - -	1	1				X	X
K30D - - - - -	(3	1	X	X	X	X	X
	(3	12	X	X	X	X	X
33A-33AG - - - - -	1	1				X	X
K34B - - - - -	3	1	X	X	X	X	X
36A- - - - -	1	1				X	X
K36B-BK36B-L36B-M36C-BM-36C- L36C-KX36C - - - - -	3	1	X	X	X	X	X
KX36A - - - - -	1	1	X	X	X	X	
36D-L36D- - - - -	(4	2	X	X	X	X	X
	(5	5	X	X	X	X	X
	(7	12	X	X	X	X	X
K36H-M36H-M36HG - - - - -	(4	4	X	X	X		X
	(5	1	X	X	X		X
	(7	12	X	X	X	X	X
L40S1-L4032 - - - - -	(2	1	X	X	X	X	X
	(3	12	X	X	X	X	X
	(4	4	X	X	X	X	X
42A - - - - -	1	1				X	X
42A1 - - - - -	1	1				X	
42A2-42B2 - - - - -	7	1	X	X	X	X	X
K42B-L42B-M42B-KX42B-LX42B- L42BX-K42C-L42D - - - - -	3	1	X	X	X	X	X
BK42D-K42D-L42D - - - - -	(3	1	X	X	X	X	X
	(3	12	X	X	X	X	X
LX42D-L42DX - - - - -	(1	2	X	X	X	X	X
	(1	7	X	X	X	X	X
K42E-L42E - - - - -	3	1	X	X	X	X	X
K42F - - - - -	1	2	X	X	X		X
42HA-K42HJ-M42H-M42HG - - -	(4	4	X	X	X		X
	(5	1	X	X	X		X
	(7	12	X	X	X	X	X
KX42C - - - - -	3	1	X	X	X	X	X

BALLAST TUBES (Continued)

<u>TUBE TYPE</u>	<u>SELECTOR</u>		<u>SHORT SWITCH POSITION</u>				
	A	B	1	2	3	4	5
L42S1 - - - - -	(2	1	X	X	X	X	X
	(3	12	X	X	X	X	X
	(4	4	X	X	X	X	X
49A-49AJ-K49AJ - - - - -	1	1				X	X
KX49A - - - - -	3	1	X	X	X	X	X
49A1 - - - - -	1	1				X	
49A2-49B2 - - - - -	7	1	X	X	X	X	X
K49B-L49B-M49B-BM49B-K49C-L49C- M49C-BM49C-BK49C-K49E-L49E- - -	3	1	X	X	X	X	X
K49D-BK49D-L49D - - - - -	(3	1	X	X	X	X	X
	(3	12	X	X	X	X	X
L49F - - - - -	1	2	X	X	X		X
M49H-M49HG - - - - -	(4	4	X	X	X		X
	(5	1	X	X	X		X
	(7	12	X	X	X	X	X
KZ49B-KZ49C - - - - -	1	1	X	X	X	X	X
K49BJ-L49BJ - - - - -	(7	1	X	X	X	X	X
	(8	12	X	X	X	X	X
L49S2 - - - - -	(2	1	X	X	X	X	X
	(3	12	X	X	X	X	X
	(4	4	X	X	X	X	X
49AJ-K49AJ- - - - -	1	1	X	X	X	X	X
KX49B-LX49B-LX49C - - - - -	3	1	X	X	X	X	X
L49DJ - - - - -	(4	2	X	X	X	X	X
	(7	5	X	X	X	X	X
	(8	12	X	X	X	X	X
L49S3 - - - - -	(2	1	X	X	X	X	X
	(3	12	X	X	X	X	X
	(4	4	X	X	X	X	X
50A2 - - - - -	3	1	X	X	X	X	X
50X3 - - - - -	1	1	X	X	X	X	
50A2MG-50B2- - - - -	1	1	X	X	X	X	X
K52H-M52H - - - - -	(4	4	X	X	X		X
	(5	1	X	X	X		X
	(7	12	X	X	X	X	X

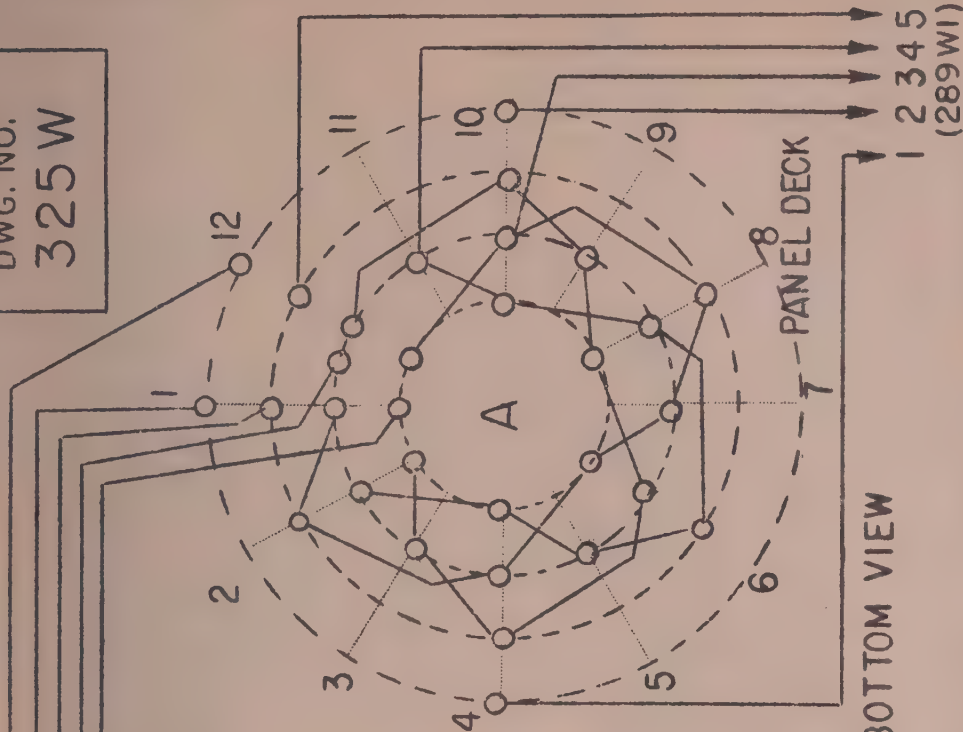
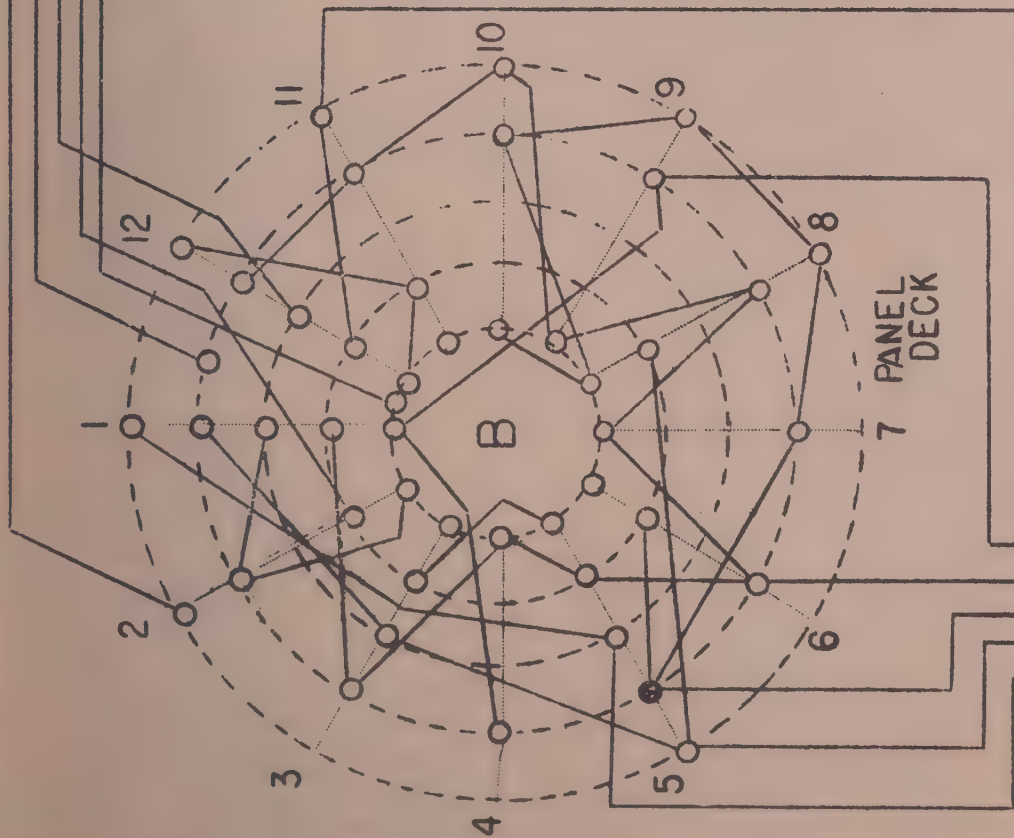
BALLAST TUBES (Continued)

<u>TUBE TYPE</u>	<u>SELECTOR</u>		<u>SHORT SWITCH POSITION</u>				
	A	B	1	2	3	4	5
K54B - - - - -	3	1	X	X	X	X	X
55A-K55A - - - - -	1	1				X	X
55A1 - - - - -	1	1				X	
KX55A - - - - -	1	1	X	X	X	X	
55B-K55B-M55B-BM55B-L55BG-LX55B	3	1	X	X	X	X	X
55A2-55B2 - - - - -	7	1	X	X	X	X	X
K55C-L55C-KX55C - - - - -	3	1	X	X	X	X	X
K55CP - - - - -	(4	12		X	X	X	X
	(1	11	X	X	X	X	X
	(1	9	X	X	X	X	X
K55D-L55D - - - - -	(3	1	X	X	X	X	X
	(3	12	X	X	X	X	X
L55E-M55E - - - - -	3	1	X	X	X	X	X
L55F-M55F-BL55F - - - - -	1	2	X	X	X		X
K55H-M55H-M55HG - - - - -	(4	4	X	X	X		X
	(5	1	X	X	X		X
	(7	12	X	X	X	X	X
L55S1-L55S2 - - - - -	(2	1	X	X	X	X	X
	(3	12	X	X	X	X	X
	(4	4	X	X	X	X	X
60R30G - - - - -	3	1	X	X	X	X	X
64.23- - - - -	1	1				X	
67A- - - - -	1	1				X	
K67B-L67B- - - - -	3	1	X	X	X	X	X
L73B-K74B-L74B-CX74C - - - - -	3	1	X	X	X	X	X
80A - - - - -	1	1				X	X
K79B-K80B-M80B-K80C-KX80B-L80B -	3	1	X	X	X	X	X
K80F - - - - -	1	2	X	X	X		X
KX87B-LX87B-L90B - - - - -	3	1	X	X	X	X	X
K90F-M90F-K92F-M92F - - - - -	1	2	X	X	X		X
92A - - - - -	1	1				X	X
L92B-95K2 - - - - -	3	1	X	X	X	X	X
L99D - - - - -	(3	1	X	X	X	X	X
	(3	12	X	X	X	X	X
100R8 - - - - -	3	1	X	X	X	X	X
120R- - - - -	1	1	X	X	X	X	
120R8-135K1 - - - - -	3	1	X	X	X	X	

BALLAST TUBES (Continued)

<u>TUBE TYPE</u>	<u>SELECTOR</u>		<u>SHORT SWITCH POSITION</u>				
	A	B	1	2	3	4	5
135K1A - - - - -	(7 (8	1 12	X X	X X	X X	X X	X X
140L4-140L8-140R4-140R8- - - -	3	1	X	X	X	X	X
140R - - - - -	1	1	X	X	X	X	
140L44-140R44- - - - -	(1 (1	2 7	X X	X X	X X	X X	X X
165L4-165L8-165R4-165R8- - - -	3	1	X	X	X	X	X
165R - - - - -	1	1	X	X	X	X	
165L44-165R44 - - - - -	(1 (1	2 7	X X	X X	X X	X X	X X
185L4-185L8-185R4-186R8 - - - -	3	1	X	X	X	X	X
185R - - - - -	1	1	X	X	X	X	
185L44-185R44- - - - -	(1 (1	2 7	X X	X X	X X	X X	X X
200R-250R - - - - -	1	1	X	X	X	X	
250R8-290L4 - - - - -	3	1	X	X	X	X	X
300R4-320R4 - - - - -	3	1	X	X	X	X	X
340 - - - - -	1	1	X	X	X	X	
808-1 - - - - -	(7 (8	1 12	X X	X X	X X	X X	X X
E14980-W43357-W45788-3613 - - -	3	1	X	X	X	X	X
3334-3334A - - - - -	(3 (3	1 12	X X	X X	X X	X X	X X
8593-8598-8601-8664 - - - - -	(3 (4	1 2	X X	X X	X X	X X	X X
3ER248 - - - - -	(7 (8	5 12	X X	X X	X X	X X	X
3CR241 - - - - -	(3 (3	1 12	X X	X X	X X	X X	X X

DWG. NO.
325W



BOTTOM VIEW

PANEL DECK

PERMUTATOR SWITCH

MODEL 530-510 X

THE HICKOK ELECT. INST. CO.

CLEVELAND, OHIO U.S.A.

A B C D E F
(289WI)



